Chapter 4

WEED CONTROL IN IMPROVED GROUNDS—TURF AND HORTICULTURAL PLANTINGS

Section A—Controlling Weeds in Turf

4-1. The Importance of Good Cultural Practices:

a. The best defense against weeds is a dense, vigorously growing turf. Weeds have difficulty gaining a foothold in good turf. To grow dense, vigorous turf, it is necessary to have the best varieties of adapted grass species, good soil conditions, correct soil acidity, proper fertilization, proper watering, correct mowing, and control of weeds, insects, diseases, and nematodes.

b. Weeds can become a problem if the turf is weakened or partially lost because of mechanical disturbances, excessive use, drought, or poor soil conditions. Also, some weed species are particularly strong competitors.

c. The first step in weed control is to correct any improper cultural practices that are causing thin, weedy turf. Turf maintenance practices vary with climate, soil type and condition, turf species, and management objectives. The installation land management plan and the county Agricultural Extension Service should be consulted for appropriate local practices.

4-2. Adjusting Soil pH. A pH in the range of 6.0 to 7.0 is considered best for turf grass because it provides the most favorable nutrient availability and microbial activity.

a. In acidic soils in the eastern United States there is frequently a need to apply ground agricultural limestone. Soil pH and the amount of lime needed should be determined by soil tests. In areas of higher rainfall, acid sandy soils generally require applications of about 25–50 lb per 1000 ft^2 of ground or pulverized limestone annually and clay soils require heavier applications of about 50–100 lb per 1000 ft^2 annually until the soil pH rises to about 6.5. Therefore, apply lime every 2 to 3 years based on soil test recommendations. Lime may be applied at any season, but late fall or winter is the best time. The rain and snow that fall after application will carry the lime into the soil before spring and summer, when the greatest growth of turf occurs.

b. In areas having soils with a high pH, chlorosis of turf may be a problem. Chlorosis is characterized by a yellowish appearance caused by a deficiency of chlorophyll. Agricultural grade sulfur may be used to lower the soil pH, but, if misapplied, it can injure turfgrasses. Other treatments include using ferric sulfate and acidifying nitrogen fertilizers, such as ammonium sulfate, to prevent iron chlorosis by allowing nutrient release during cool soil conditions. Obtain advice from the county agricultural extension agent on the treatment to be used.

4-3. Fertilizing Turf. Nitrogen is the nutrient most often needed in turf. It and the two more common fertilizer elements, phosphorus and potassium, should be in good supply when the turf is growing most rapidly. Fertilizing should be based on the results of soil testing. The Cooperative Agricultural Extension Service will make the analyses and recommend soil treatments.

a. In the northern temperate climate, fertilize cool-season grasses most heavily in the fall. Fertilize less, if at all, in early spring. In cool-season grass turf, nitrogen levels in the soil should be declining before periods of expected hot or dry weather. Nitrogen is seldom used in the summer. Annual rates of application range from 2 to 5 lb of nitrogen per 1000 ft^2.

b. Fertilize warm-season grasses much as bermudagrass, zoysiagrass, and St. Augustinegrass with nitrogen during the spring and summer. Use annual rates of 1 or 2 lb of nitrogen on zoysiagrass and 2 to 5 lb per 1000 ft^2 on St. Augustinegrass and bermudagrass.

c. Take extra precautions in applying fertilizer-herbicide "weed and feed" mixtures. Don't overtreat by making a second or third trip around trees and shrubs to give them an extra feeding of fertilizer. Such extra trips can apply too much herbicide and injure or kill the trees and shrubs. Do not use fertilizer-herbicide mixtures each time the grass needs fertilizer.

4-4. Watering Turf. Proper watering is important in maintaining high quality turf.

a. Watering must be frequent enough to ensure proper soil moisture. Sandy soils have low moisture-holding capacity and require frequent watering. Clay soils retain more water, and therefore, should be watered less frequently but in larger amounts. Do not water grass unless it shows signs of wilt. Then apply enough water, usually about an inch, to wet the soil 6 inches or more deep.

b. Water must not be applied faster than it can be absorbed by the soil. Avoid frequent, light watering. This is wasteful, causes shallow growth of grass roots, and stimulates germination and growth of weeds. For example, light, frequent watering encourages the invasion of annual bluegrass and crabgrass.

4-5. Mowing Turf. Mowing at the proper time and height greatly improves weed control.

a. Mow most cool-season turf grasses about weekly to a height of 2.5 to 3.5 inches. Closer mowing, especially in hot weather, weakens cool-season turf and invites weed invasion. Crabgrass infestations, in particular, can be reduced by the shading effect of a taller, denser stand of turf grass on the crabgrass seedlings. Invasion of spotted spurge, another warm-season weed, also can be reduced by high mowing.

b. Mow warm-season grasses, particularly bermudagrass, closer than most cool-season grasses. Bermudagrass should be cut to a height of 1.5 to 2 inches. Others, such as zoysiagrass, centipedegrass, and carpetgrass, should be mowed to a height of about 1 inch. St. Augustinegrass and bahiagrass should be cut to 2.5 to 3.5 inches.

c. Mow lawns frequently,and keep the mower blades sharp. Unless growth or thatch layers are excessive, and there are weeds setting seed in the lawn, leave the clippings on the grass. A mower with a mulching blade increases the rate of decomposition of the clippings. Do not let grass grow unusually high. No more than 1/3 the length of the grass leaf should be removed at a clipping. If a lawn is to be mowed to 2 inches, then mow the grass before it exceeds 3 inches in height.

4-6. Aerating, Verticutting, and Dethatching:

a. In some areas, turf requires aerating, verticutting, or dethatching to improve growing conditions. These operations should be performed when the turf will regenerate quickly. Furthermore, these operations should not uncover the soil or leave it bare at the time of year when seeds of crabgrass, annual bluegrass, or goosegrass germinate. These weeds rapidly invade open areas. Early fall is the best time to renovate cool-season turfs. Early summer is the best time to renovate warm-season grasses.

b. These management operations should not be performed following preemergence herbicide applications, or the weeds will not be controlled. If a preemergence herbicide is applied immediately after verticutting or dethatching, the regrowth of the grass may be suppressed.

4-7. Using Selective Herbicides. Herbicides are available for most of the weeds found in lawns and other turf areas, but they should be used only when necessary and as part of a complete turf management program.

a. General Information:

(1) Selective herbicides can be used to control most weed species without injuring turf grass, but they must be selected and applied with care. An excessive dose of almost any herbicide will damage lawn grasses, and a herbicide may kill one weed but not control others. To control some weeds it may be necessary to use herbicides that temporarily, or even permanently, injure lawn grasses.

(2) Most lawn weeds are either grasses or broadleafs. Crabgrass, goosegrass, foxtail, and barnyardgrass are examples of annual grass weeds. Dandelions, plantains, and chickweed are examples of broadleaf weeds. Nutsedge is a narrow-leaf weed that is not a grass.

(3) Each type of weed requires different herbicides for effective control; but the herbicides used for crabgrass are usually effective on most other annual grasses, and the herbicides used for dandelion, plantain, and chickweed are usually effective on most other broadleaf weeds. Herbicides for weed grasses in turf and for broadleaf weeds in turf are shown in attachments 10 and 11, respectively. The effectiveness of the herbicides varies, as shown in attachment 12.

(4) The herbicides chosen should be both effective for the weeds present and safe for turf and ornamental plants. Attachment 13 shows the soil persistence and potential hazards of herbicides to trees, shrubs, turf grass, and herbaceous broadleaf plants.

(5) The herbicides chosen must also be safe for people and animals using the area. Attachment 4 shows toxicities of herbicides. When used according to label directions, the recommended herbicides will not damage plants and will pose little hazard to the user, other persons, pets, and wildlife in the area. Always read and follow the directions and precautions on the label.

b. Applying Herbicides:

(1) There are three types of herbicide application: (1) Preplanting—application before seeding or sodding turf, (2) Preemergence—application before weed seeds germinate, and

(3) Postemergence—application after weeds emerge. Repeated treatments, or a sequence of treatments at set intervals, are sometimes required in order to kill weeds without excessive injury to the turf. Always read instructions on the label, and pay particular attention to limitations on use.

(2) Granular herbicides are ready to use as purchased. Granular herbicide particles are usually relatively large and drift less than liquid sprays. Granular materials are best applied with a spinner type spreader. Use the spreader setting recommended by the manufacturer or listed on the herbicide label. Take extra precautions in applying fertilizer-herbicide "weed and feed" mixtures. Do not make second or third trips around trees and shrubs to give them an extra feeding of fertilizer, and do not use a fertilizer-herbicide mixture each time the grass needs fertilizing.

(3) Liquid and wettable powder formulations are added to water and applied as sprays. use a sprayer that can be adjusted to make a coarse spray at a low pressure of less than 35 lb/in^2. On very small areas you can use a garden sprinkling can. Care must be taken in handling sprays, especially herbicides such as 2,4-D, dichloprop, mecoprop, and dicamba. Drift of even small amounts of these can damage trees, shrubs, flowers, and vegetables. Make treatments only when there is little or no wind. Usually 1 to 3 gallons of spray mixture per 1000 ft^2 of lawn are used. Within these limits, the volume of spray used is not important. It is extremely important, however, to use the proper dosage of herbicide per 1000 ft^2. (To convert a per acre rate to a per 1000 ft^2 rate, divide by 43.6.)

(4) The most convenient equipment for applying sprays to small areas is the pressure or knapsack sprayer of 1- to 4-gallon capacity. These sprayers provide a fairly consistent volume of spray at low pressure and provide good control in limiting the spray to the target area. Continuous agitation, by frequent shaking of sprayer tank, is necessary when using the wettable powder or emulsifiable formulations, or they will settle out.

(5) One method of treating small patches and individual weeds is to use a small paint brush or sponge nailed or wired to a broomstick or dowel. Mix a small amount of herbicide in a container that has a large enough opening so that the sponge or brush can easily be dipped. After dipping, squeeze out the excess by pressing the brush or sponge against the inside of the container. Simply "paint" or dab the weed. Such devices are available commercially. When using this method, dilute the herbicide as if it were to be sprayed. Do not use full strength chemical, or turf injury will result.

(6) *Do not use equipment that has been used for herbicides to spray fungicides or insecticides on other plants such as flowers or vegetables.* There may be enough herbicide residue in the sprayer to injure these plants.

c. Controlling Weed Grasses. Recommended herbicides are shown in attachment 10.

(1) Crabgrasses and other annual summer grasses can be a problem in lawns in most areas of the United States. Preemergence herbicides applied before seed germination give the best control. The best indicator of the right time for application is when the soil temperature reaches 50°F. A less precise indication is when forsythia is flowering or when lilacs are about to bloom. In most warm- and cool-season turf grasses, DCPA, benefin, bensulide, pendimethalin, siduron, and oxadiazon applied before the weed seeds germinate provide control. Only siduron can be used on newly seeded, cool-season turf areas. Other materials have a specified waiting period (2 months or more) before overseeding is recommended. If no rainfall is received within 2 or 3 days after treatment, sprinkle irrigation is recommended.

(2) In centipede, St. Augustine, and zoysia grasses, granular atrazine may be used (attachment 11) to control weeds such as crabgrass, *Paspalum spp.*, spotted spurge, and several other annual broadleaf weeds.

(3) Some of the other weedy annual summer grasses that can be controlled with preemergence herbicides include barnyardgrass, fall panicum, foxtail, and goosegrass. Goosegrass is usually the most difficult to control.

(4) Some control of seedling and juvenile plants of crabgrass, foxtail, goosegrass, sandburs, and other annual summer grasses can be gained with postemergence use of feroxaprop in a single application, or methanearsonate herbicides (DSMA, MSMA, CMA, and MAMA) repeated in two to three treatments at 7- to 10-day intervals. To be effective, and to minimize turf injury, soils should have enough moisture to support active growth.

(5) Goosegrass tends to be a problem where soils are compacted, turf is thin, and preemergence herbicides have not been used. Goosegrass

seeds germinate in spring and summer later than crabgrass. Preemergence treatments for crab grass control should be reinforced with a second application at 1/3 to 1/2 the initial rate in 4 to 5 weeks to provide better goosegrass control. Most herbicides give variable results, but oxadiazon tends to be more reliable than the others. Sometimes it may be best to till the fumigate the soil, correct the causes of the goosegrass problem, and reseed or sod in the fall to allow time for a dense turf to develop before the next spring.

(6) Annual bluegrass tends to be a major problem in closely mowed turf, such as putting greens, in thin turf, and along turf borders. It is a cool-season species whose seeds can germinate throughout the year, except in the deep South. Most preemergence herbicides used in cool-season grasses give only partial control. Good turf-management practices, including infrequent irrigation and high mowing, may limit infestation.

(7) Annual bluegrass can be well controlled in bermudagrass in the southeastern states by using metribuzin or pronamide as either a preemergence or postemergence treatment. Do not overseed treated areas for 90 days after application of pronamide. Pronamide will kill most cool-season turf species. Ethofumesate will safely control annual bluegrass in perennial ryegrass and dormant bermudagrass, but will injure other turf grass species.

(8) Bermudagrass, quackgrass, zoysiagrass, kikuyugrass nimblewill, and other perennial grasses that spread by horizontal stems, either below or above ground, often occur as weeds in cool-season turf grasses. They can be controlled by the methods of renovating turf that are discussed in section B. Glyphosate (3 to 6 tablespoons per gal water) is a good nonselective foliage spray for spot treatments. Such spreading perennial grasses often have dormant buds at the joints of the spreading stems that may not be killed by a single treatment of herbicide. When practical, a second application 1 to 2 months later increases the chance of eradicating these species. Close observation for any live plants should continue for many months or years after treatment. Because glyphosate is effective only when applied to leaves, an abundance of foliage on the weed grasses in necessary at the time of application. Treated spots can be seeded, sprigged, or sodded soon after treatment. Any reinfestation should be spot-treated as soon as observed.

(9) Tall fescue, timothy, orchardgrass, and other perennial bunch grasses give a clumpy appearance to fine turf because of their rapid growth. If only a few clumps occur, they can be removed by cutting under them shallowly with a spade, or the bunch grasses can be spot sprayed with glyphosate. The bare spots then can be resodded, or filled with topsoil and seeded.

(10) Dallisgrass and some other *Paspalum* species can be selectively controlled by repeated postemergence spraying with DSMA and other methanearsonate herbicides at the highest rates recommended on the label. Multiple methanearsonate treatments, however, may severely damage cool-season turf grasses such as Kentucky bluegrass.

d. Controlling Broadleaf Weeds. Recommended herbicides are shown in attachment 11.

(1) Broadleaf weed-control herbicides are usually applied as postemergence treatments to the foliage and stems of actively growing weeds. Most should be applied in early fall, to allow grass to fill the spaces left by dead weeds, or in the spring.

(2) Most broadleaf weeds can be controlled by using one of the commercially available products containing 2,4-D in combination with dicamba, mecoprop, dichlorprop, triclopyr, or chlorsulfuron. In newly seeded turf, bromoxynil (0.38 and 0.5 lb/a) will control many seedling broadleaf weeds. For weeds not controlled by these herbicides you may consult your local County Agricultural Extension Service for specific recommendations. Do not mow turf for at least 3 days before application so that there will be maximum weed foliage to receive the herbicide spray. Do not mow or water the turf for at least 2 days after treatment.

(3) When a granular 2,4-D or similar herbicide for broadleaf weed control is used, be sure to follow the instructions on the label. It is generally recommended that such formulations be applied either when the weed leaves are moist with dew in the early morning or just *after* the lawn is watered. The herbicide granules retained in water droplets on the leaves are readily absorbed.

(4) A high percentage of lawn weeds are controlled by 2,4-D, but there are some common weeds it does not control. Weeds that are not well controlled by 2,4-D, but that may be controlled by dicamba, include knotweed, red sorrel, white clover, henbit, chickweeds, black medic, ground ivy, yellow woodsorrell, wild

strawberry, knawel, and many others. Do not apply dicamba within the "drip line" of shrubs and trees.

(5) Speedwells and prostrate spurge are not well controlled with 2,4-D and the herbicides commonly sold in mixtures with it, except when the plants are quite young. These weeds can be suppressed, however, with sprays of DCPA (attachment 10) applied when forsythia is flowering or lilacs are about to bloom. Postemergence application of bromoxynil (0.38 to 0.5 lb/a) on young spurge plants may further reduce infestation.

(6) Yellow nutsedge is a perennial that reproduces in lawns mainly by underground nutlets that persist in the dormant stage. If there are only a few plants, persistently pulling the plants before each mowing will control them. Heavy infestations are controlled with difficulty, and often incompletely, but they can be reduced with two or three treatments of bemtazon or DSMA, or other methanearsonates, in late June and July (attachment 10). Allow 7 to 14 days between treatments. Repeated, heavy treatments with 2,4-D will also reduce stands of yellow nutsedge. Temporary, slight discoloration of the lawn may result.

(7) Wild garlic and onion produce hard-shelled bulbs that may lie dormant underground and continue to produce plants for about 3 years. Therefore, controlling this species requires three annual treatments with 2,4-D made in late winter or very early spring. Low-volatile ester formulations are more effective than amine salts. Early spring treatment with chlorsulfuron is also an effective control for wild garlic.

Section B—Renovating Turf and Treating New Seedings

4-8. Spot Infestations and Degraded Turf:

a. Sometimes a turf will have spot infestation of undesirable grasses or will be generally degraded with weeds and mixed grass species, and these conditions cannot be corrected with selective herbicides. For example, a Kentucky bluegrass turf may be invaded by a coarse grass such as tall fescue, or pernicious perennials such as bermudagrass, zoysiagrass, bentgrass, quackgrass, or nimblewill. These unwanted grasses cannot be controlled selectively in Kentucky bluegrass. They must be killed, and the desired turf must then be reestablished. Spot treatments may be sufficient, or entire lawns may need to be replaced, depending upon the situation.

b. The renovating should be done at a time that will favor establishing the desired turf grass species, i.e., when rainfall is expected to be adequate to germinate the selected grass seeds, especially if irrigation is not available, and when competing weeds will be least troublesome. Early fall (September in most regions) is best time to establish Kentucky bluegrass, tall fescue, and other cool-season grasses. The varieties of turf grass selected should be those best adapted to the region. In some situations, and with some turf species, sodding or sprigging will be done rather than seeding. The installation land management plan should be consulted, or local advice should be obtained, because conditions and the adapted turf grass species vary greatly among regions.

4-9. Renovating Turf With Herbicides:

a. A number of herbicides will kill all established vegetation. Some herbicides require no waiting period between treatment and seeding, while others leave toxic residues and require waiting periods of 20 to 50 days before seeding.

b. No seedbed tillage is necessary after vegetation is killed by herbicides, provided the turfgrass seeds are placed in contact with the mineral soil. A disk seeder accomplishes this task. Usually seed in two passes that cross one another at right angles. If excessive thatch is present, then tillage, verticutting, or thorough raking with a thatch rake will be necessary. When tillage is limited, germinating weed seeds can cause severe weed problems, and supplemental weed control is often required.

c. Glyphosate is used as a foliage spray and effectively controls grasses and broadleaf weeds (attachment 10). Plants should have well-developed foliage and be growing actively when sprayed. Glyphosate is translocated throughout the plant. Therefore, the vegetation should not be mowed, verticut, or cultivated for 3 or more days after treatment. Glyphosate is water soluble and will be partially washed off of plants if rainfall or sprinkle irrigation occurs within 6 hours of treatment.

d. When making spot treatments, be careful to confine the spray to the area that needs to be treated. For weed species that have rhizomes and stolons that grow outward, such as bermudagrass, the sprayed area should extend at least 12 inches beyond the observed plants.

e. Most cool-season grasses and annual grasses can be killed with glyphosate at 1.5 lb/a. Almost all plants of such strongly spreading

grasses as bermudagrass can be killed with a single spraying with glyphosate at 4 lb/a under favorable conditions. In most regions, however, two treatments 1 to 2 months apart at 1.5 to 2 lb/a are slightly more effective in controlling bermudagrass and zoysiagrass. There should be enough moisture available to allow dormant buds to develop between treatments. Under drier conditions, the turf can be verticut or cultivated 7 days after treatment and the area completed dried out to kill any remaining dormant buds.

f. Turf grasses can be seeded soon after treatment with glyphosate, since it leaves no residues in the soil that are toxic to germinating grass seeds. Glyphosate does not move laterally in runoff water from the treated area, but do not let sprays or drift contact the foliage of desirable plants, or injury will result.

g. Amitrole is a foliage-applied, translocated herbicide which will control most annual and some perennial grasses when applied at 3 to 4 lb/a. Better control is achieved if the weeds are growing vigorously in moist soil. If rain or watering occurs within 12 hours after treatment, amitrole may be washed off of leaves, and reduced control will result. If it does not rain within 5 to 7 days after treatment, heavy irrigation should be applied. Ten to 14 days after treatment, when the grass or weeds are white or brown, the area should be cultivated. This can be done by digging, tilling, or otherwise loosening and drying the treated areas. Verticutting, aerating, or raking the area is not enough. If bermudagrass regrows, allow it to reach 2 to 3 inches in height and treat it again. The area should be tilled again in 10 days, and then seeded.

4-10. Renovating Turf by Tilling:

a. Existing turf can be removed by a sod cutter or a flat shovel in small areas, and the area can be cultivated with rotary-tillage equipment. Many weeds are easily killed by cultivating and drying. If time is available, fallowing the soil and cultivating at intervals of 3 to 5 weeks will eliminate many of the weeds arising from seeds and vegetative parts in the soil.

b. Lime and fertilizer should be applied, as needed, and the seed should be planted in a smooth, firm seedbed. Use high quality weed-free seed of a locally adapted turf variety. The seed may be broadcast on the surface and raked in, or it may be shallow drilled. It may be advantageous to cover the surface lightly with a straw mulch, peat, or compost. If seed is broadcast on the soil surface, wet the seed and soil with sprinkle irrigation daily for 7 to 14 days until seedling plants are visible. Then water less frequently. Sodded areas must be irrigated several times each day during hot and dry periods until the grass is well rooted in the soil.

c. Tillage is seldom adequate to control such pernicious perennial species as quackgrass, bermudagrass, zoysiagrass, and nutsedge. When renovating areas infested with such species, a herbicide such as glyphosate, that has little or no residual toxicity in the soil, should be used before tilling; or a soil fumigant should be used after tilling.

4-11. Controlling Persistent Weeds With Soil Fumigation. Soil fumigation before seeding or planting turf species is effective in controlling persistent weeds if used on moist, tilled soil.

a. Metham is a fumigant used to kill germinating seeds, rhizomes, tubers, roots, and stems of weeds in soil. The soil should be cultivated and kept moist for a week before applying metham. Then treat with 1 to 2 pints of commercial formulation mixed in 2 to 5 gallons of water, in a sprinkling can or sprayer, for each 100 ft^2 of soil. The treated area should then be irrigated until the soil is wet as deep as control is desired. An air-tight cover can be spread over the treated area and its edges covered with soil to substitute for a water seal. This greatly increases the effectiveness of the fumigant as a herbicide. The area can be seeded 14 to 21 days after treatment.

b. Methyl bromide is a RESTRICTED use that is very poisonous and may be used only by a certified applicator. It is particularly effective for controlling pernicious weed species having nutlets, bulbs, corms, and lateral underground stems. It also kills most seeds and disease organisms in the soil. It does not control hard seeds of clover, dichondra, or field bindweed. Apply methyl bromide at 1 lb/100 ft^2 when the soil temperature is above 60°F. and under a well sealed, air-tight cover. Because of the poisonous nature of the gas, strict precautions must be followed. The cover can be removed 2 days after treatment, and the area can be seeded 2 days later.

4-12. Controlling Weeds in New Seedings:

a. The most important steps in controlling weeds in new seedings is to thoroughly eradicate the existing weeds, to use high quality, weed-free

seed, and to use good cultural practices in establishing the new turf. Every effort should be made to establish a vigorous turf in which weeds have difficulty becoming established.

b. In spring or early summer seedings of cool-season turf species, germinating crabgrass, foxtail, and bermudagrass can be controlled by an application of siduron at seeding.

c. Some weeds in new seedings can be controlled by a proper balance of mowing, irrigating, and fertilizing. If seedling broadleaf weeds threaten to shade out turf grass seedlings, even after one or two mowings, they can be controlled with herbicides. A mixture of 2,4-D with other herbicides can be used effectively on cool-season grass seedlings of such species as Kentucky bluegrass, red fescue, and tall fescue if applied at 1/4 to 1/3 the rate used in established turf (attachment 11). Such treatments should be delayed 5 weeks or more after seeding. Also, bromoxynil at 0.38 to 0.5 lb/a alone, or in combinations with dicamba at 0.13 to 0.25 lb/a, effectively controls many annual broadleaf weeds in new seedlings.

Section C—Controlling Weeds in Horticultural Plantings

4-13. Uses of Herbicides. Herbicides can be used in landscape plantings to reduce the hand labor required for maintenance. Sites that can be treated include shrubs and trees along roads, ornamental beds, windbreaks, ground covers, and shrubbery and flowers around buildings. Some herbicides may be used in bulbs and in herbaceous annuals and perennials. Because no one herbicide is effective and safe on all plants and in all situations, care must be taken in their selection and application.

4-14. Selecting Herbicides:

a. Important factors in selecting herbicides for landscape uses include: the weed species and their stages of growth, the ornamental plants to be maintained, the hazard to sensitive plantings downslope, and the hazard to trees and shrubs from root uptake. Most of these factors are addressed on the herbicide label.

b. Herbicides can be used effectively before planting (preplanting), after planting but before weed emergence (preemergence), or, in some instances on actively growing weeds (postemergence). Herbicides that are registered for these uses in ornamental plantings are given in attachments 14, 15, 16, and 17. Herbicides that are registered for use in ground covers and flowers are shown in attachments 18 and 19, together with the plants for which they are registered.

4-15. Measuring Small Quantities of Herbicides. Ornamental plantings usually occupy small areas, and only small quantities of herbicides are needed. Attachment 20 shows equivalent doses per acre and per 1000 ft^2 for some of the herbicides that are registered for ornamentals, and it also tells how to make the conversion.

Section D—Controlling Vegetation Around Structures

4-16. Hazards of Soil Sterilants:

a. Many of the soil sterilants that are used around buildings and other structures are hazardous in the root zones of trees and shrubs, and are hazardous to plants downslope. Tree roots may extend as far, or further, laterally as their tops grow high. They may be up to 60 to 100 feet from the trunks. A toxic herbicide can be absorbed by the roots, translocate to foliage, and kill or injure the tree.

b. Herbicides that are hazardous to use adjacent to landscape plantings include: atrazine, prometon, bromacil, diuron, tebuthiuron, hexazinone, dicamba, and picloram. The very low rates of dicamba (0.125 to 0.25 lb/a) used in turf are not hazardous to trees growing in the area. The relative hazards of many herbicides to desirable plants are listed in attachment 13.

4-17. Recommended Treatments. A safe herbicide mixture to use around buildings, parking lots, fence lines, guard rails, and other structures where root zones of desirable woody plants may be contacted is the foliage herbicide glyposate at 1 to 4 lb/a, plus simazine at 3 to 4 lb/a, plus oryzalin at 4 to 5 lb/a. The latter two are absorbed from the soil. Spray on actively growing weeds. Paraquat at 0.5 to 1 lb/a could substitute for glyphosate in this mixture. If the herbicide mixture is to be adjacent to turf, omit the simazine.